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Arduino based dc motor control-"an application of artificial intelligence"

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Abstract
This paper is a study of minimization of human energy in machine control (control of direction of rotation of dc motor) using artificial intelligence .i e with the help of an arduino board [arduino mega 2560], which is an IDE , that helps in uploading the program code ,with the circuit connected to it. The main component is the "L298 H bridge ic", that can accept TTL logic, which helps to overcome the basic problem, which is faced in reversing the direction of the motor using digital pins.

Keywords: *DC motor, Arduino board, ATmega2560, H bridge ic, battery.*

INTRODUCTION

The DC motor which is most commonly used, employs the conversion of direct current electrical energy into mechanical energy. It can provide a broad range of speed control and constant torque application. In normal applications the use of dc motor is very less, as it needs extra components like rectifiers, commutators etc. But whereas in case in industrial drives, steel mills, mines, electrical tractions etc., it is very necessary to control the speed as well as direction of rotation of the motor used.

Thus using an integrated development environment, we develop a control mechanism for the control of direction of rotation of dc motor, with the major role played by the "L298 H bridge ic".

The L298 H bridge ic, can apply the voltage across the load, in any of the directions (clockwise or anti clockwise). It is a duplex full bridge driver circuit, which consists of fifteen leads. The circuit consists of four transistors and resembles the English alphabet "H", thus the name H bridge. Integrated circuit packaging is the last step involved in the process of assembly, before testing and shipping of the product. There exists a very large number of package types, among which the L298 ic, has a Power SO20 packages, which is a new high power ic surface mount package, done using surface mount technology (SMT).

Arduino is a developed board having microcontroller chip embedded in it. It helps in building up projects based on microcontroller board design. The board helps you to avail digital and analog input and output pins, that acts as an interface with the circuit connected to it. It also consists of serial communication interfaces, including universal serial bus (bus). Thus indirectly provides an integrated development environment, based on programming languages, which supports C and C++.

The arduino board used in this project is, the arduino Mega 2560, the microcontroller based board based on the ATmega2560 (datasheet).

There are many functions present in arduino which helps in building the program codes required for the functioning of the circuits interfaced to it. Thus helps in easy and fast prototyping. It minimizes the amount of hardware and software requirements and makes the functioning very simple, with the help of the libraries it provides, it makes the environment very flexible for operation.

The main industrial applications of a dc motor are electrolytic processes, welding operations, variable speed motor drives, machines where severe torque variations occur.

The dc series motor is used for providing very high starting torque, variable speed can also be obtained. i.e. in traction drives, compressors, sewing machines, vacuum cleaners and so on.

The shunt motors provides a constant speed, but no severe initial conditions are found. Some of its applications are pumps, lathe machines, centrifugal fans, lifts, blowers, sewing machines etc.,

In applications where higher starting torque is required compound motors are employed.

Though there exists the rectification process of converting the ac power supply to dc, because of its features like high starting torque which are used in heavy duty machines, this information focusses on the control of the rotation of the dc motor using an artificial intelligence i.e an ardruino board. that makes the control simpler and easy. Block diagram of dc motor control using arduino mega 2560

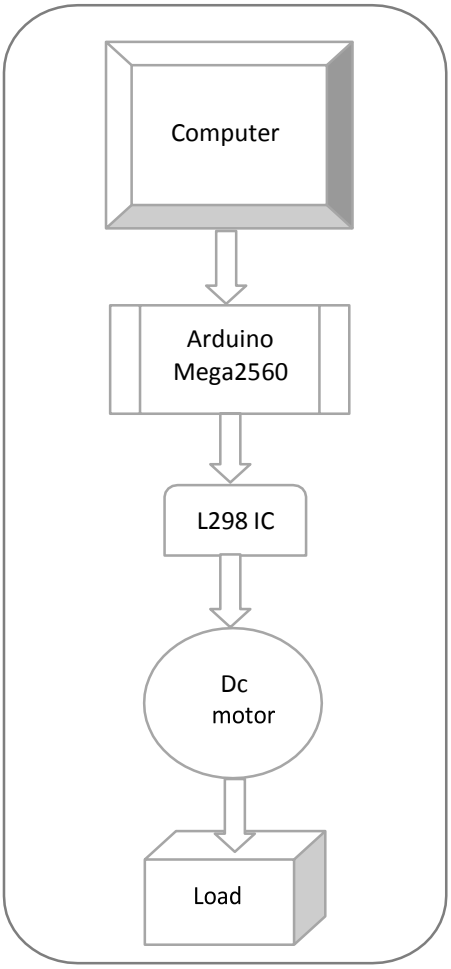


Fig1: *Block diagam representation.*

The components used in this project are arduino mega2560, L298 h bridge ic, dc motor, pc with arduino software.

The Arduino mega 2560: The mega 2560 has 54 input/output pins of which 15 can be used as PWM outputs, 16 analog pins, 4 UARTS i.e hardware serial ports, it uses a 16 MHz crystal oscillator, a USB connector and it is also provided with a reset button. Thus it contains everything that is required to support a microcontroller and can be readly connected to a computer with a USB cable or power it with a ac to dc adapter, or else use a battery as a means of power supply to it. Here a 5volts operating voltage is applied, as the input voltage limit is 6-15volts.

5volt pin and ground of arduino is connected to the supply and ground of the H bridge ic. Pin 8 and 9 are connected from the input pins of ic, pin 2 is been connected to the enable pin of the ic. These are the respective pin connections taken from the arduino mega 2560.

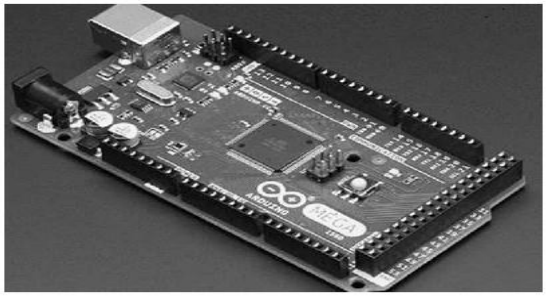


Fig 2: *Arduino mega board*

L298 H Bridge ic: This is a dual H Bridge Motor driver, having 15 leads. It can accept standard TTL logic levels, high voltage, current and is a full bridge driver ic, can drive inductive loads such as relays, stepping motors etc.,

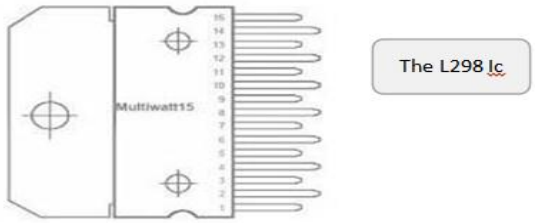


Fig 3: *L298ic*

The pin details of the ic are: 5,7,10,12: input pins, 2,3,13,14: output pins, 1,15: are current sensing pins, 4,9:supply voltage, 8: ground, 6,11:enable pins. In this scenario we don't need all the pins, as we use ic to control only one dc motor.

Pin number 4 and 9 are provided with a 5volt pin from the arduino board, pin 2 and 3 of ic is connected to the leads of the dc motor, pin 7 and 5 are the input pins connected to pin number 8 and9 of the board, the enable pin 6 is connected from pin2 of arduino, the current sensing pin1 is connected to ground of arduino board.**Source code:**

Code i.e. uploaded to the IDE, arduino mega2560 board.

```
constint pwm =2;  //initializing pwm of arduino board// constint in_1=8;  // directing pins of the board as input
//
constint in_2=9;

 //for providing logic to L298 ic and to choose the direction for the motor//

viodsetup ()
{
pinMode(pwm,output);  //pwm pin has to be set as an output//
pinMode(in_1,output);  // logic pins set as output//
pinMode(in_2,output);
}

Voidloop()
{
 //for clockwise rotation input 1 is set high and input 2 as low//
digitalWrite(in_1,high);
digitalWrite(in_2,low);
analogWrite(pwm,255);
delay(3000);  //clockwise for three seconds//

//for brake//

digitalWrite(in_1,high);
digitalWrite(in_2,high);
delay(1000);  //delay of one second//

//for anticlockwise motion input 1 is set low and input pin
2  is  set  high//
  digitalWrite(in_1,low);
digitalWrite(in_2,high);
delay(3000);  //delay of three seconds//

//for  brake//
```

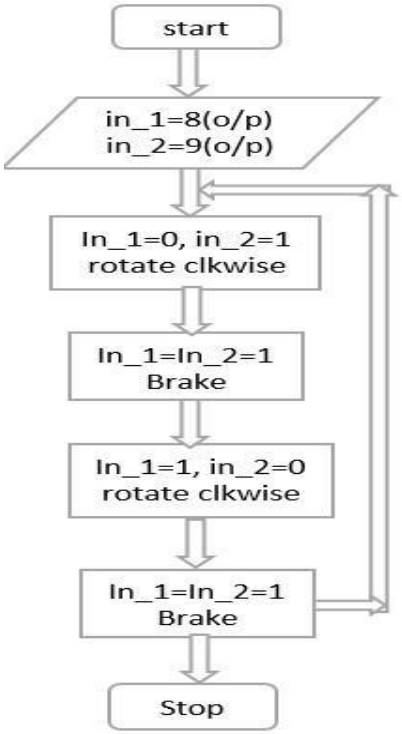
```
digitalWrite(in_1,high);
digitalWrite(in_2,high);
delay(1000);          //delay of one seconds//
}
```

The looping repeats , until the board is reset again.

Algorithm

1) Set the pulse width modulation. assigning pin number
2) pin 8, 9 are initialized as the input pins.
3) Assign 8, 9 that takes input from the board as output.
4) Pin 8 is high and pin 9 is low, rotate the motor in cloclwise direction for about three seconds.
5) Create a pause or a brake , by making both the pins high.
6) Set pin 8 as low and pin 9 as high to rotate the motor in anti clockwise direction.
7) Again repeat step five for break mechanism.
8) The looping operation repeats.

Flowchart



Picture representing the circuit:

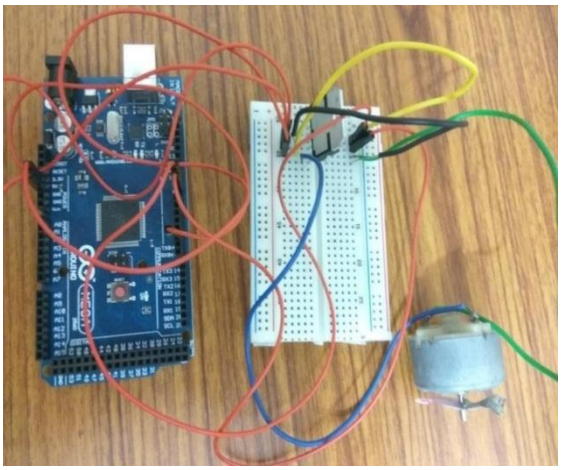


Fig 4: *Hardware representation.*

CONCLUSION

The major task achieved using an artificial intelligence is the control of direction of rotation of dc motor without changing its lead manually, Instead it is done with the help of code which is being processed by the Atmega 2560 controller, mounted on the arduino board.

Generally if the two leads of the dc motor is connected to a battery, the motor rotates, if you alter the supply given to the leads, the direction of rotation of the motor also changes. Thus the control on direction of dc motor without changing the leads, is successful using the H bridge ic, which can drive the motor in both the directions. The most common application i.e. found in today's life is robots, where in the movements of robots can be modified using such control with built in ic .

The current world is associated with computer controlled machines, termed as CCM, which are majorly used in manufacturing industries, such artificial intelligence will increase the efficiency and the quality of the product and its operation too.

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List of figures: